What do biofungicides add to vegetable disease management? Part 1 – Introducing the project

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This summer we compared three biofungicides added to a conventional cucurbit powdery mildew management program in field trials conducted in western and eastern NY and on Long Island. Photo credit: Caitlin Vore, Cornell Vegetable Program

What we're doing

During the summer of 2018 Amara Dunn, the NYS IPM biological pest management specialist, worked with colleagues (Elizabeth Buck, Dr. Julie Kikkert, Dr. Margaret McGrath, Jud Reid, and Crystal Stewart) on a project funded by the New York Farm Viability Institute looking at the use of biofungicides (Remember what biofungicides are?) in vegetable disease management. Dr. Darcy Telenko (formerly of the Cornell Vegetable Program) helped plan the project before starting her new position at Purdue University, and Dr. Sarah Pethybridge provided valuable advice based on her extensive work with white mold (including control with biofungicides). BASF, Bayer, BioWorks, Certis, Dow, and Marrone BioInnovations provided product for the field trials.

The project has two goals:

1) Quantify what biofungicides add to management of cucurbit powdery mildew and white mold in terms of…

- disease control
- yield
- plant health
- economic value (comparing yield gains to fungicide costs)

2) Evaluate the utility of NDVI (normalized difference vegetation index) as a measure of plant health and disease detection in fresh vegetables.

Why this project?

For both diseases (cucurbit powdery mildew and white mold), we're considering biofungicides used with other pest management strategies – other biofungicides, conventional chemical fungicides, and/or cultural practices. Biofungicides are not expected to be silver bullets, and they work best when used in an IPM strategy. But when deciding whether or how to use them in your operation, it's good to know what value you're getting for the extra costs of purchasing and applying the products. This summer we ran trials in three major vegetable-producing regions of the state: western New York, eastern NY, and on Long Island.

Biofungicides for cucurbit powdery mildew

Cucurbit powdery mildew looks like a dusting of powdered sugar on the cucurbit leaf. These powdery spots start on the underside of the leaf, and then develop on the upper surface of the leaf, so excellent spray coverage is important. Photo credit: Amara Dunn, NYS IPM

For combatting cucurbit powdery mildew, we're comparing three biofungicides: LifeGard (*Bacillus mycoides* isolate J), Regalia (extract from the giant knotweed plant *Reynoutria sachalinensis*), and Serifel (*Bacillus amyloliquefaciens* MBI 600). All three were applied weekly starting when the plants were small. Then, when the first signs of powdery mildew showed up, we started a rotation of conventional fungicides (Vivando, Quintec, and Luna Experience). These three treatments plus a rotation of all-organic fungicides (LifeGard, MilStop, Serifel, and a mineral oil) are being compared to two control treatments: the conventional fungicides alone, and plants that received no treatment for powdery mildew. We ran the trials on a variety of bushing acorn squash ('Honey Bear') that has intermediate resistance to powdery mildew.

Biofungicides for white mold

In the white mold trial, we're looking at Double Nickel (*Bacillus amyloliquefaciens* strain D747) alone or in combination with Contans

continued on next page

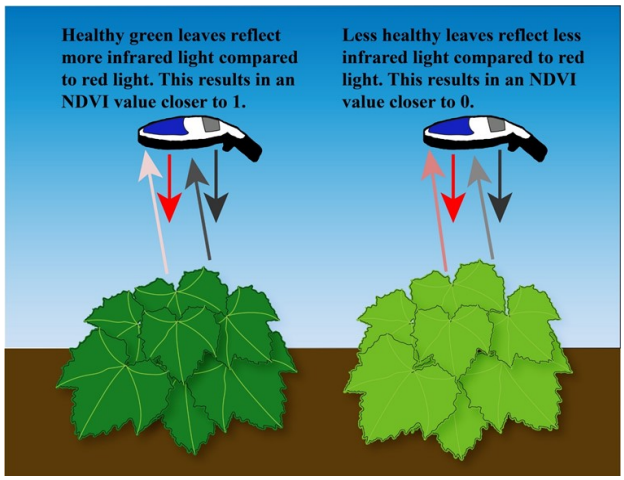
(*Paraconiothyrium minitans* strain CON/M/91-08; formerly *Coniothyrium minitans*). Next year we'll look at these biofungicides in combination with reduced tillage at one site. Reduced tillage is another IPM strategy for white mold. The active ingredient in Contans is a fungus that eats the resting structures (sclerotia) of the fungus that causes the disease white mold. Because of this, it needs time to work, and is applied either in fall or spring. The goal is to reduce the number of sclerotia present in the next crop. Next year we'll collect data on whether application of Contans reduced disease. In the meantime, during the 2018 growing season treatments we tested were Double Nickel, Cueva (an OMRI-approved copper) and no treatment for white mold on snap bean. Previous research by the EVADE Lab at Cornell AgriTech at The New York State Agricultural Experiment Station, Geneva, New York, has shown that Double Nickel is a promising biofungicide for white mold.

Most vegetable crops are susceptible to white mold, with legumes being among the most vulnerable. The name comes from the dense white "tufts" that the fungus forms. These develop into dark, hard sclerotia that can survive for years in the soil. Photo credit: Amara Dunn, NYS IPM

What is NDVI, anyway?

In a nutshell, the "normalized difference vegetation index" (NDVI) is a way to quantify how much healthy, green foliage is present. The device we used emits different types (wavelengths) of light (red and near infrared), and measures how much of each type of light is reflected back from the leaves of the plant. Leaves that are dark green and healthy reflect more infrared light and absorb a lot of red light. Less healthy leaves reflect less infrared light. A NDVI value closer to 1 indicates healthier plants. A NDVI value closer to 0 indicates less healthy plants (or more bare ground).

NDVI and similar indices are already used in other crops and in other places to help growers make decisions about when to fertilize, or to help detect parts of a field where a pest may be present. So far in NY, NDVI is not being widely used by fresh market vegetable growers for disease detection. Collecting NDVI data from this project will do two things:



NDVI (normalized difference vegetation index) quantifies the amount of dark green foliage based on how much light of different wavelengths is reflected. It is used in some crops to decide when to apply fertilizer, or to help detect below-ground pests. Photo credit: Amara Dunn, NYS IPM

1) Help us quantify the health of plants. Even though NDVI is not a measure of disease, we would expect to see more healthy foliage if biofungicides are contributing to disease control.

2) Provide some preliminary data to help us determine whether NDVI measurements could be useful to NY fresh vegetable growers.

Field meetings were held at each powdery mildew trial location so that local growers could see the trials and hear about the project. We're currently wrapping up data analysis from the 2018 field season. You'll be able to learn about results from the first year of this two-year project at winter meetings around NY, in extension newsletters, and on the IPM biocontrol blog. Also, stay tuned for Part 2 with details about how these biofungicides work (modes of action), and how to use them most effectively.

Growers and industry reps had a chance to visit the 2018 cucurbit powdery mildew field trials shortly before they were harvested. Photo credit: Amara Dunn, NYS IPM